The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

Note
The solutions shown are but one of many possible solutions.

MATHEMATICS A

Thursday, January 25, 2007 — 1:15 to 4:15 p.m., only

Print Your Name: Imaginary Student (i)

Print Your School's Name: Imaginary H.S.

Print your name and the name of your school in the boxes above. Then turn to the last page of this booklet, which is the answer sheet for Part I. Fold the last page along the perforations and, slowly and carefully, tear off the answer sheet. Then fill in the heading of your answer sheet.

Scrap paper is not permitted for any part of this examination, but you may use the blank spaces in this booklet as scrap paper. A perforated sheet of scrap graph paper is provided at the end of this booklet for any question for which graphing may be helpful but is not required. You may remove this sheet from this booklet. Any work done on this sheet of scrap graph paper will *not* be scored. All work should be written in pen, except graphs and drawings, which should be done in pencil.

This examination has four parts, with a total of 39 questions. You must answer all questions in this examination. Write your answers to the Part I multiple-choice questions on the separate answer sheet. Write your answers to the questions in Parts II, III, and IV directly in this booklet. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc.

When you have completed the examination, you must sign the statement printed at the end of the answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet cannot be accepted if you fail to sign this declaration.

Notice. . .

A minimum of a scientific calculator, a straightedge (ruler), and a compass must be available for you to use while taking this examination.

The use of any communications device is strictly prohibited when taking this examination. If you use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

MATHEMATICS A

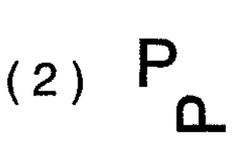
Part I

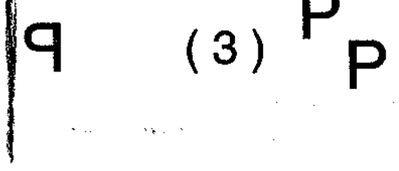
Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each question, write on the separate answer sheet the numeral preceding the word or expression that best completes the statement or answers the question. [60]

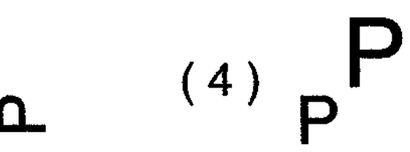
Use this space for computations.

1 Which image represents a line reflection?

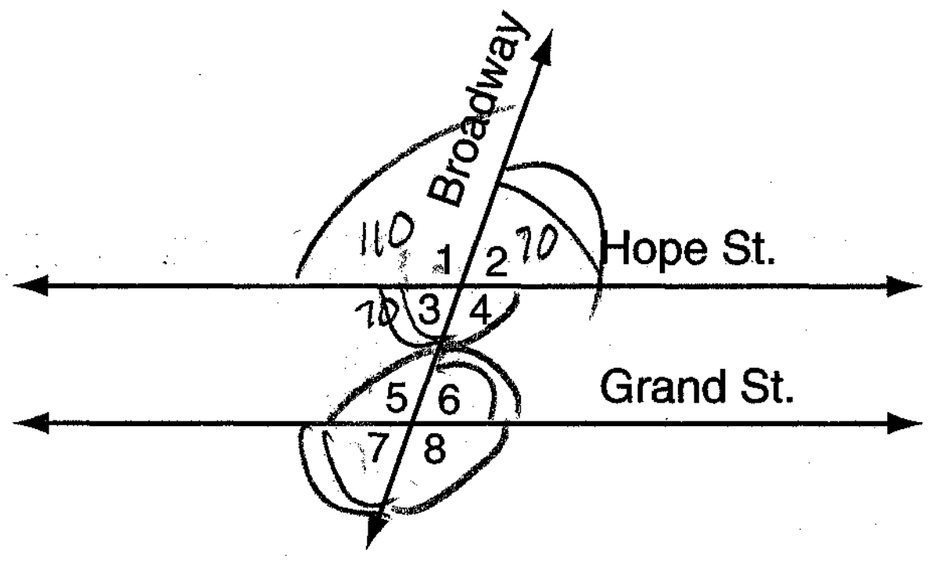
(1) 

(2) 

(3) 

(4) 

2 The accompanying diagram shows two parallel roads, Hope Street and Grand Street, crossed by a transversal road, Broadway.

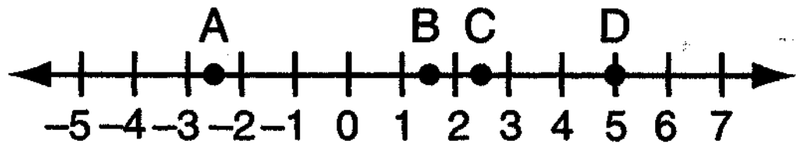


If m∠1 = 110, what is the measure of ∠7?

(1) 40°
(2) 70°
(3) 110°
(4) 180°

Use this space for computations.

3 Which point on the accompanying number line best represents the position of $\sqrt{5}$?

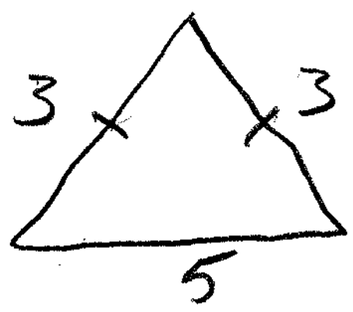


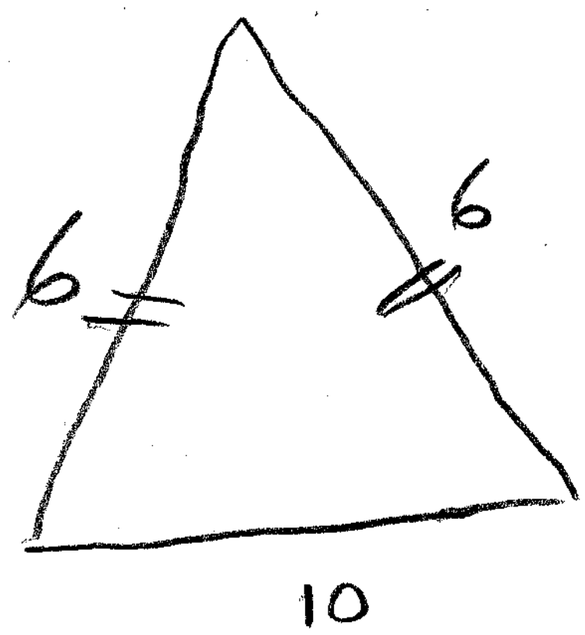
(1) *A*
(2) *B*
(3) *C*
(4) *D*

$\sqrt{5} = 2.2360679 77\ldots$

4 The base of an isosceles triangle is 5 and its perimeter is 11. The base of a similar isosceles triangle is 10. What is the perimeter of the larger triangle?

(1) 15
(2) 21
(3) 22
(4) 110





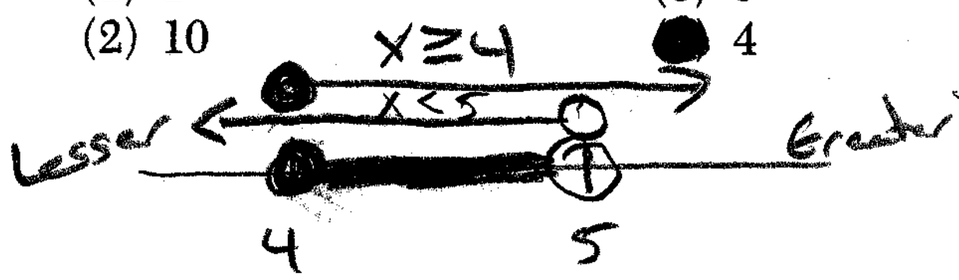
5 What is the value of n in the equation $3n - 8 = 32 - n$?

(1) –10
(2) –6
(3) 6
(4) 10

$3n - 8 = 32 - n$
$+n \qquad +n$
$4n - 8 = 32$
$+8 \quad +8$
$4n = 40$
$n = 10$

6 The statement "$x \geq 4$ and $2x - 4 < 6$" is true when x is equal to

(1) 1
(2) 10
(3) 5
(4) 4



$2x - 4 < 6$
$+4 \quad +4$
$2x < 10$
$x < 5$

7 The expression $(2x^2 + 6x + 5) - (6x^2 + 3x + 5)$ is equivalent to

(1) $-4x^2 + 3x$
(2) $4x^2 - 3x$
(3) $-4x^2 - 3x + 10$
(4) $4x^2 + 3x - 10$

$2x^2 + 6x + 5$
$-6x^2 - 3x - 5$
$-4x^2 + 3x$

Use this space for computations.

8 Which equation represents the direct variation relationship of the equation $\frac{x}{y} = \frac{1}{2}$?

$2X = Y$

$Y = 2X$

(1) $y = x + \frac{1}{2}$

(3) $y = 3x$

● $y = 2x$

(4) $x = 2y$

9 Seth tossed a fair coin five times and got five heads. The probability that the next toss will be a tail is

(1) 0

(3) $\frac{5}{6}$

(2) $\frac{1}{6}$

● $\frac{1}{2}$

It is always $\frac{1}{2}$. The first five tosses are independent of the next toss.

"A coin has no memory"

10 The formula for potential energy is $P = mgh$, where P is potential energy, m is mass, g is gravity, and h is height. Which expression can be used to represent g?

$P = (m)g(h)$ Isolate g

$P = (mh)g$

$D_{(mh)} \frac{P}{mh} = g$

(1) $P - m - h$

(3) $\frac{P}{m} - h$

(2) $P - mh$

● $\frac{P}{mh}$

11 A planned building was going to be 100 feet long, 75 feet deep, and 30 feet high. The owner decides to increase the volume of the building by 10% without changing the dimensions of the depth and the height. What will be the new length of this building?

length depth height
$100 \times 75 \times 30 = 225{,}000\ ft^3$

10% increase $= 22{,}500$

(1) 106 ft

● 110 ft

(2) 108 ft

(4) 112 ft

Volume of new building

$225{,}000$
$22{,}500$
$247{,}500$

Depth + height stay the same

$X\,(75)(30) = 247{,}500$

$X(2250) = 247{,}500$

$X = 110$

Use this space for computations.

12 Which expression represents the product of two consecutive odd integers, where n is an odd integer?

(1) $n(n+1)$
(2) $n(n+2)$
(3) $n(n+3)$
(4) $2n+1$

13 Which value is equivalent to ${}_3P_3$?

(1) 1
(2) 9
(3) 3!
(4) 27

${}_3P_3 = 3 \cdot 2 \cdot 1 = 6$

$3! = 3 \cdot 2 \cdot 1 = 6$

14 The graph of the equation $x^2 + y^2 = r^2$ forms

(1) a circle
(2) a parabola
(3) a straight line
(4) two intersecting lines

15 What is the inverse of the statement "If (Bob gets hurt) then (the team loses the game)"?

(1) If the team loses the game, then Bob gets hurt.
(2) Bob gets hurt if the team loses the game.
(3) If the team does not lose the game, then Bob does not get hurt.
(4) If Bob does not get hurt, then the team does not lose the game.

rhymes with ~ which stands for not

If 1, then 2
If not 1, then not 2
If Bob does not get hurt, the the team does not lose the game.

16 Which expression is undefined when $w = 3$?

(1) $\frac{w-3}{w+1}$ $3+1=4$
(2) $\frac{w^2+2w}{5w}$ $5 \cdot 3 = 15$
(3) $\frac{w+1}{w^2-3w}$ $9-9=0$
(4) $\frac{3w}{3w^2}$ $3(3)^2 = 27$

undefined happens when the denominator is zero.

Use this space for computations.

17 A circular garden has a diameter of 12 feet. How many bags of topsoil must Linda buy to cover the garden if one bag covers an area of 3 square feet?

(1) 13
(3) 40
● 38
(4) 151

$A_o = \pi r^2$

$A_o = 36\pi$

$A_o = 113.097\,3355$

$\frac{113.097\,3355}{3} = 37.699\,1184$

18 The midpoint of $\overline{AB}$ is (–1,5) and the coordinates of point A are (–3,2). What are the coordinates of point B?

● (1,8)
(3) (0,7)
(2) (1,10)
(4) (–5,8)

(–3,2) A —— (–1,5) MP —— (x_2, y_2) B

$m_p = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$(-1,5) = \left(\frac{-3 + x_2}{2}, \frac{2 + y_2}{2}\right)$

$-1 = \frac{-3 + x_2}{2}$ $\quad 5 = \frac{2 + y_2}{2}$

$-2 = -3 + x_2$ $\quad 10 = 2 + y_2$

$1 = x_2$ $\quad 8 = y_2$

19 What is the value of x in the equation $\frac{x}{2} + \frac{x}{6} = 2$?

(1) 12
● 3
(2) 8
(4) $\frac{1}{4}$

$\frac{x}{2} + \frac{x}{6} = 2$

$\frac{6x + 2x}{12} = 2$

$\frac{8x}{12} = 2$

$8x = 24$

$x = 3$

20 If M and A represent integers, $M + A = A + M$ is an example of which property?

● commutative
(3) distributive
(2) associative
(4) closure

21 A set of five quadrilaterals consists of a square, a rhombus, a rectangle, an isosceles trapezoid, and a parallelogram. Lu selects one of these figures at random. What is the probability that both pairs of the figure's opposite sides are parallel?

(1) 1
(3) $\frac{3}{4}$
● $\frac{4}{5}$
(4) $\frac{2}{5}$

$P(\text{event}) = \frac{\text{desired outcome}}{\text{total possible outcomes}}$

$P_{(2\parallel \text{sides})} = \frac{\text{square} + \text{rhombus} + \text{rectangle} + \text{parallelogram}}{5 \text{ quadrilaterals}} = \frac{4}{5}$

Use this space for computations.

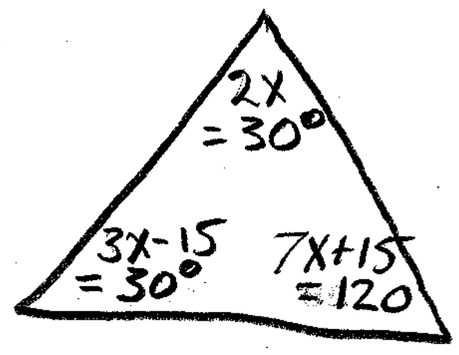
22 If the measures of the angles of a triangle are represented by $2x$, $3x - 15$, and $7x + 15$, the triangle is

(1) an isosceles triangle
(2) a right triangle
(3) an acute triangle
(4) an equiangular triangle

$2x + 3x - 15 + 7x + 15 = 180$

$12x = 180$

$x = 15$



23 What is the value of $3^0 + 3^{-2}$?

(1) 0
(2) $\frac{1}{9}$
(3) $1\frac{1}{9}$
(4) 6

$3^0 = 1$

$3^{-2} = \frac{1}{9}$

$1 + \frac{1}{9} = 1\frac{1}{9}$

24 The expression $(50x^3 - 60x^2 + 10x) \div 10x$ is equivalent to

(1) $5x^2 - 6x + 1$
(2) $5x^3 - 6x^2 + x$
(3) $5x^2 - 60x^2 + 10x$
(4) $5x^2 - 6x$

$\frac{50x^3 - 60x^2 + 10x}{10x}$

25 The image of point A after a dilation of 3 is (6,15). What was the original location of point A?

(1) (2,5)
(2) (3,12)
(3) (9,18)
(4) (18,45)

$\left(\frac{6}{3}, \frac{15}{3}\right)$

$(2, 5)$

26 Mario paid \$44.25 in taxi fare from the hotel to the airport. The cab charged \$2.25 for the first mile plus \$3.50 for each additional mile. How many miles was it from the hotel to the airport?

(1) 10
(2) 11
(3) 12
(4) 13

first mile → 2.25; each additional mile → $3.5m$

$44.25 = 2.25 + 3.5m$

$42 = 3.5m$

$12 = m$

12 miles plus 1rst mile = 13 miles total.

Check

$3.5 \times 12 = 42.00$ additional miles

2.25 first mile

$\$44.25$

Use this space for computations.

27 What is the solution set of the equation $x^2 - 5x = 0$?

(1) {0,–5}
(2) {0,5}
(3) {0}
(4) {5}

$x^2 - 5x = 0$

$x(x-5) = 0$

$x = 0 \quad x-5 = 0$

$x = 0 \quad x = 5$

28 The expression $(6x^3y^6)^2$ is equivalent to

(1) $36x^6y^{12}$
(2) $36x^5y^8$
(3) $12x^6y^{12}$
(4) $6x^6y^{12}$

$6^2(x^3)^2(y^6)^2 = 36x^6y^{12}$

29 If the Math Olympiad Club consists of eighteen students, how many different teams of four students can be formed for competitions?

(1) 66
(2) 72
(3) 3,060
(4) 73,440

$_{18}C_4 = \frac{18 \times 17 \times 16 \times 15}{4 \times 3 \times 2 \times 1}$

30 The multiplicative inverse of $-\frac{1}{3}$ is

(1) $\frac{1}{3}$
(2) $-\frac{1}{3}$
(3) 3
(4) –3

The multiplicative inverse must result in the multiplication identity element, which is a positive one.

$\left(-\frac{1}{3}\right)(-3) = 1$

$\left(\frac{-1}{3}\right)\left(\frac{-3}{1}\right) = 1$

$\frac{-1}{-1} = 1$

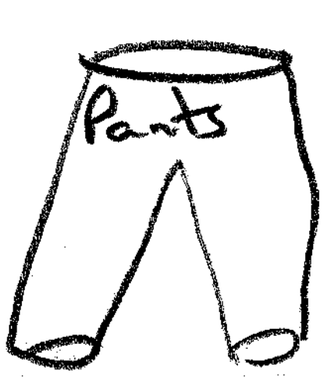
Part II

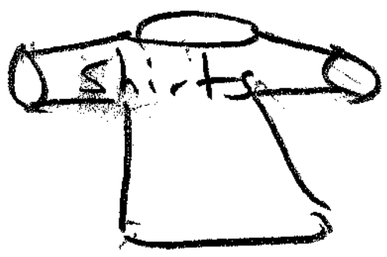
Answer all questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. [10]

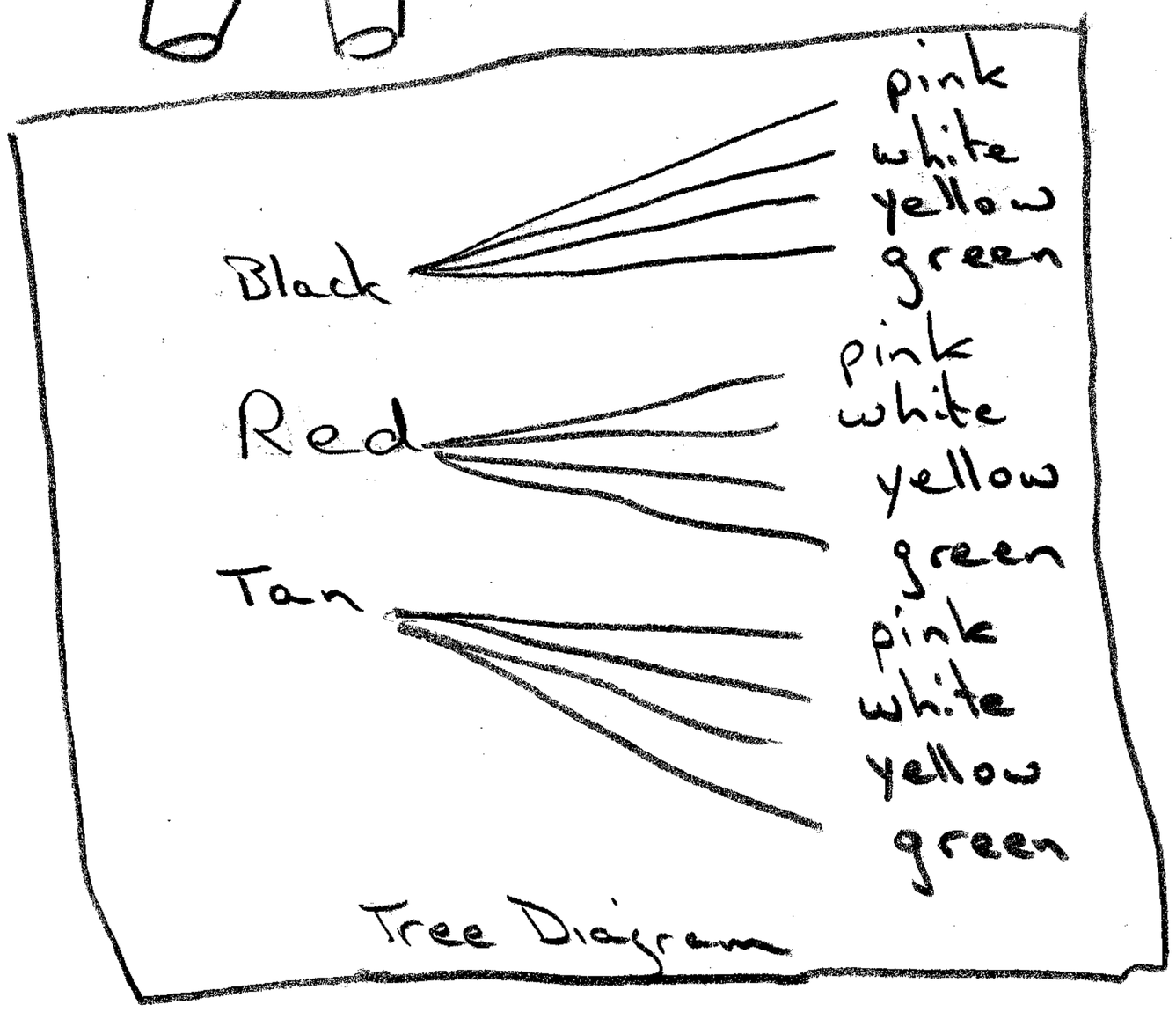
31 Kimberly has three pair of pants: one black, one red, and one tan. She also has four shirts: one pink, one white, one yellow, and one green.

Draw a tree diagram or list the sample space showing all possible outfits that she could wear, if an outfit consists of one pair of pants and one shirt.

How many different outfits can Kimberly wear?







Outfits w/ Pants / Top

Black/Pink
Black/White
Black/Yellow
Black/Green
Red/Pink
Red/White
Red/Yellow
Red/Green
Tan/Pink
Tan/White
Tan/Yellow
Tan/Green
Sample Space

Kimberly can wear 3 (Pants) × 4 (Shirts) = 12 outfits

32 A 14-gram serving of mayonnaise contains 11 grams of fat. What percent of the mayonnaise, to the *nearest tenth of a percent*, is fat?

$\frac{\text{fat}}{\text{total}} = \frac{11}{14}$ $\qquad \frac{11}{14} = \frac{x}{100}$

Cross mult.ply $\quad 11(100) = 14x$

$1100 = 14x$

D(14) $\quad \frac{1100}{14} = x$

$78.57142857 = x$

78.6 %

Check $\quad 14 \times 78.6\% = 14 \times .786 = 11.004$ ✓

33 Every month, Omar buys pizzas to serve at a party for his friends. In May, he bought three more than twice the number of pizzas he bought in April. If Omar bought 15 pizzas in May, how many pizzas did he buy in April?

Let x represent the number of pizzes bought in April.

May → 3 more than twice the number in April

$+3 \qquad +2x$

May = 15

$15 = +3 + 2x$

S(3) $\quad -3 \quad -3$

$12 = 2x$

$6 = x$

He bought **6 pizzas** in April

Check

April: OOOOOO = x

May: OOOOOO = x

OOOOOO = x

plus 3 more

OOO = 3

$15 = 2x + 3$

34 The formula $C = \frac{5}{9}(F - 32)$ is used to convert Fahrenheit temperature, F, to Celsius temperature, C. What temperature, in degrees Fahrenheit, is equivalent to a temperature of 10° Celsius?

$C = \frac{5}{9}(F-32)$

$C=10$ $\quad 10 = \frac{5}{9}(F-32)$

M(9) $\quad 90 = 5(F-32)$

D(5) $\quad 18 = F-32$

A(32) $\quad +32 \qquad +32$

$\boxed{50} = F$

Check

$10 = \frac{5}{9}(50-32)$

$10 = \frac{5}{9}(18)$

$10 = \frac{5}{9}\left(\frac{18}{1}\right)$

$10 = \frac{90}{9}$

$10 = 10$ ✓

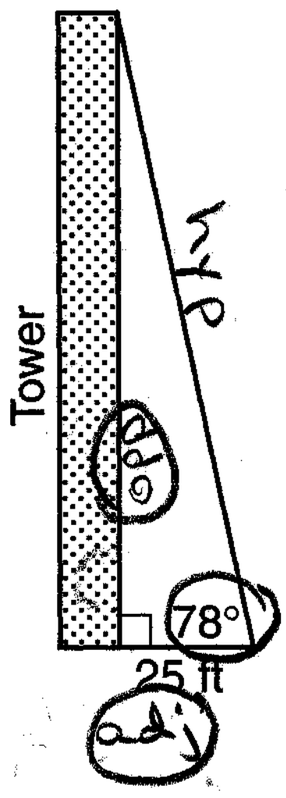
35 From a point on level ground 25 feet from the base of a tower, the angle of elevation to the top of the tower is 78°, as shown in the accompanying diagram. Find the height of the tower, to the *nearest tenth of a foot*.

SOH-CAH-TOA

$\sin = \frac{opp}{hyp}$

$\cos = \frac{adj}{hyp}$

$\tan = \frac{opp}{adj}$



$\tan 78° = \frac{opp.}{adj.}$

$\tan 78° = \frac{opp.}{25\,ft.}$

$25(\tan 78°) = opp.$

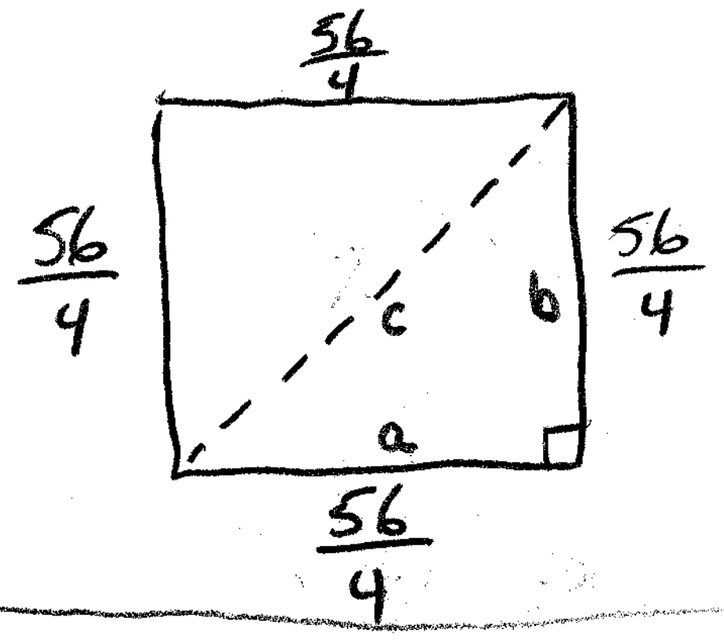
$117.6157527 = opp$

$\boxed{117.6\ ft.}$

Part III

Answer all questions in this part. Each correct answer will receive 3 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. [6]

36 The perimeter of a square is 56. Express the length of a diagonal of the square in simplest radical form.



Pythagorean Theorem

$a^2 + b^2 = c^2$

$\left(\frac{56}{4}\right)^2 + \left(\frac{56}{4}\right)^2 = c^2$

$196 + 196 = c^2$

$392 = c^2$

$\sqrt{392} = c$

$\sqrt{392} = \sqrt{2}\sqrt{196} = \sqrt{2}\,14$

$= \boxed{14\sqrt{2}}$ Answer

37 The Eye Surgery Institute just purchased a new laser machine for $500,000 to use during eye surgery. The Institute must pay the inventor $550 each time the machine is used. If the Institute charges $2,000 for each laser surgery, what is the *minimum* number of surgeries that must be performed in order for the Institute to make a profit?

Let x represent the number of times the machine is used.

Expenses = $500{,}000 + 550x$

Income = $2{,}000x$

Break even point is when expenses = income

$500{,}000 + 550x = 2{,}000x$

$-550x \quad -550x$

$500{,}000 = 1{,}450x$

$344.8275862 = x$

345 surgeries

This is a minimum to break even. Anything more is profit.

Check

Expenses = 689,750

Income = 690,000

$I > E$

Part IV

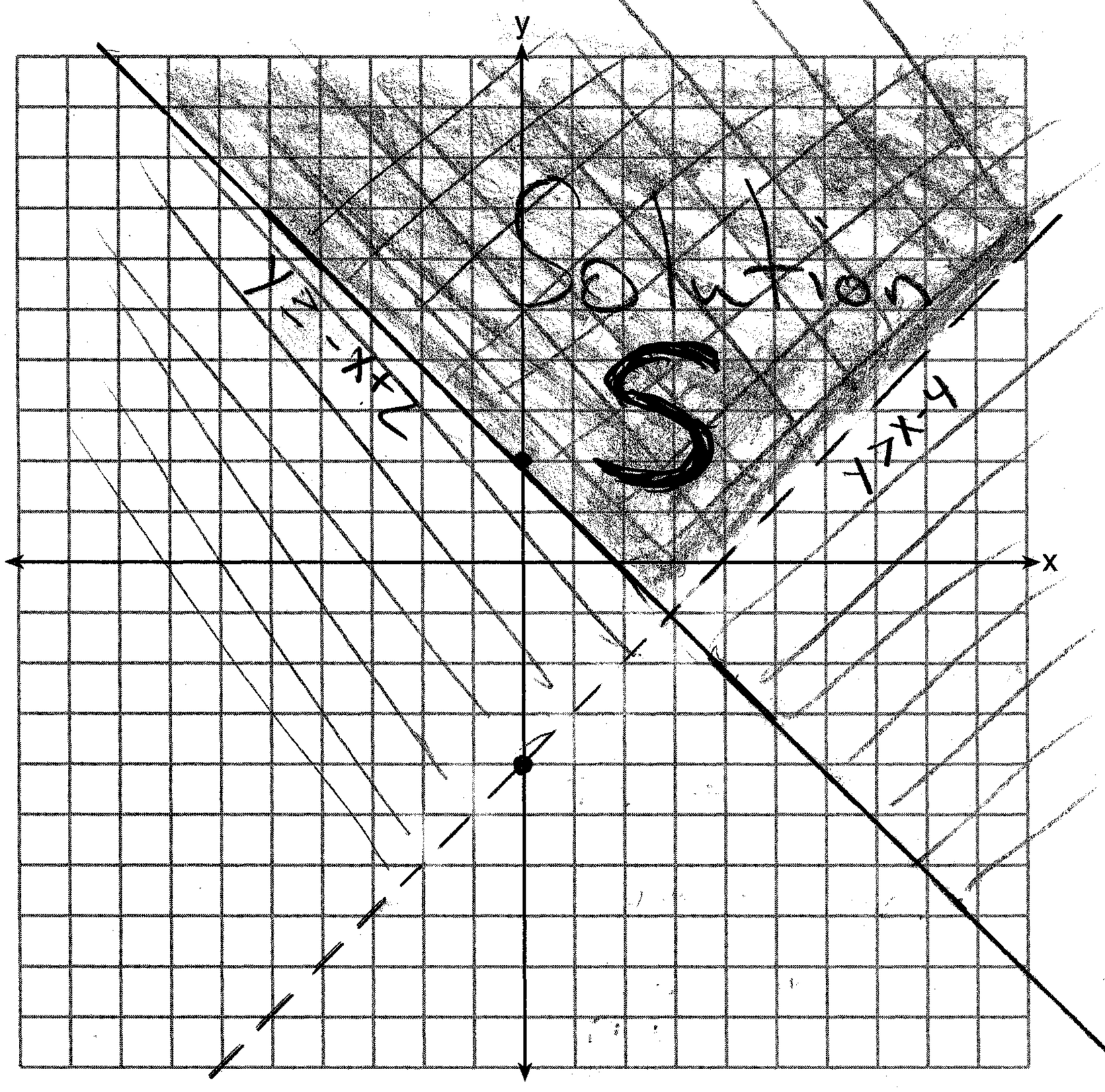
Answer all questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. [8]

38 Graph the following systems of inequalities on the accompanying set of axes and label the solution set S:

$$y > x - 4$$
$$y + x \geq 2$$

$y \geq -x+2$

[Only a graphic solution can receive full credit.]



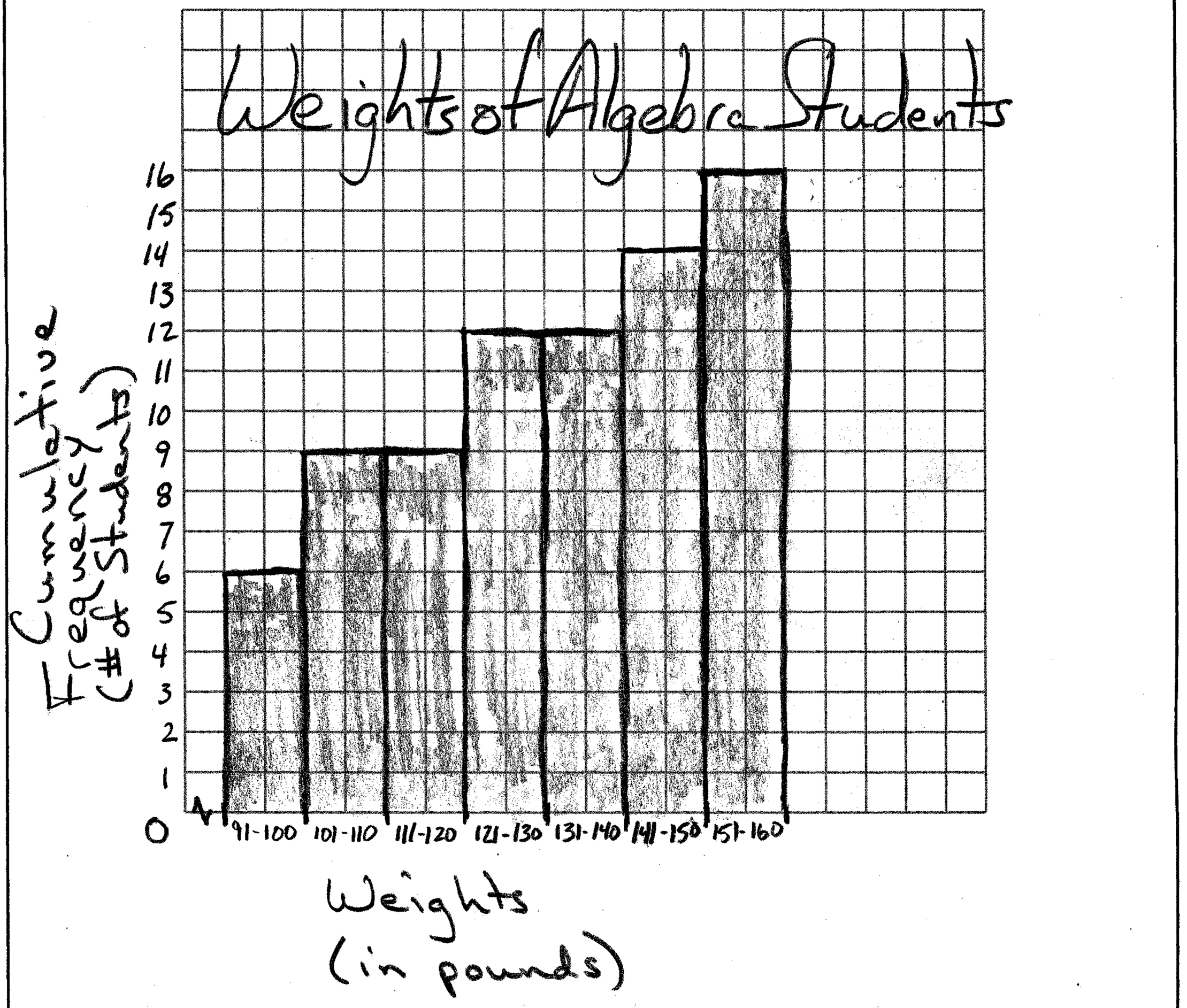
39 The accompanying table shows the weights, in pounds, for the students in an algebra class.

Using the data, complete the cumulative frequency table below and construct a cumulative frequency histogram on the grid on the next page.

Interval	Frequency	Cumulative Frequency
91–100	6	6
101–110	3	9
111–120	0	9
121–130	3	12
131–140	0	12
141–150	2	14
151–160	2	16

Sum=16

Question 39 continued



The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

MATHEMATICS A

Thursday, January 25, 2007 — 1:15 to 4:15 p.m., only

ANSWER SHEET

Student ..... Sex: ☐ Male ☐ Female Grade .....

Teacher ..... School .....

Your answers to Part I should be recorded on this answer sheet.

Part I

Answer all 30 questions in this part.

1 ..... 1	9 ..... 4	17 ..... 2	25 ..... 1 .....
2 ..... 2	10 ..... 4	18 ..... 1	26 ..... 4 .....
3 ..... 3	11 ..... 3	19 ..... 3	27 ..... 2 .....
4 ..... 3	12 ..... 2	20 ..... 1	28 ..... 1 .....
5 ..... 4	13 ..... 3	21 ..... 2	29 ..... 3 .....
6 ..... 4	14 ..... 1	22 ..... 1	30 ..... 4 .....
7 ..... 1	15 ..... 4	23 ..... 3	
8 ..... 2	16 ..... 3	24 ..... 1	

Your answers for Parts II, III, and IV should be written in the test booklet.

The declaration below should be signed when you have completed the examination.

I do hereby affirm, at the close of this examination, that I had no unlawful knowledge of the questions or answers prior to the examination and that I have neither given nor received assistance in answering any of the questions during the examination.

Signature